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Developing Innovative Applications of Technical Drawing Course at the Maritime Education

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Abstract

All the information required for the production of a detailed picture to be transferred as part of the engineering is called technical drawing. Technical drawing can be drawn within the framework of its own rules has a readable feature. Drawings can be drawn by hand, drawing equipment (pens, compasses, rulers) or the computer with the aid-funded programs. The result of industrialization in the 19th century has increased the importance of the technical drawing. Complex projects with a combination of each piece was made clear by using drawing installation images. Today, the technical picture has become an indispensable communication tool for engineering. Failed, broken or technical drawings for the explanation and description of the parts to be manufactured has become a new form of language depends on the basic standards anywhere in the world. Developments were reflected in the maritime sector. Drawing applications used in the manufacture of ships, also gained importance in the balance and construction account. Covering recent years has been facilitated by computer-aided ship design software projects that replace paper disk less space, has virtual drawings stored in CDs or external hard drives.In this study, Marine engineering drawings and computer-aided design of the importance of maritime education, are being investigated as active as long as how to switch from the traditional process of innovation. Advantages and disadvantages of innovative and traditional understanding of technical drawings were compared. Technical drawing education in Turkey and the world are examined in terms of marine engineering. The promotion of maritime drawing education as a result, the incomplete elimination, supported with computer software, which provides great opportunities for the supply part during fault in the ship along with improving the education provided in schools, therefore, has been found to reduce costs.

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Keywords: Technical Drawing , Innovation , Computer Aided Design , Maritime Education

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1. Introduction

Shipping is one of the oldest profession performed under difficult conditions. International maritime transport with 90% share of world trade has a very important place. Therefore, the staff is well-trained workers has become a necessity in the form of merchant ships. Seafarer is called the staff of merchant ships. Seafarers working on board the need for a certain organizational structure are connected to each other. The management organizational structure of a ship; consist of deck department , engine department and auxiliary department. Engine department organizational structure of merchant ships; chief Engineer, second engineer, third engineer and crew. Today, working on decreases the number of available staff ships while improving the impact of the technology. Therefore, the high knowledge of staff is expected to be qualified to be able to report that can quickly respond to malfunctions.

2. Research Goal

The aim of this study to explain the importance of the technical drawing and computer aided design for maritime industry. Also find out deficiencies, develop, disseminate and explain the solutions.

3. Marine Education

There are 111 educational maritime institutions in Turkey. International Maritime Organization attaches great importance to the training of seafarers working on ships trading with extreme operating conditions. Therefore, STCW 1978 known as the training of seafarers, training and certification and watchkeeping standards it has become canonical. Obligation to comply with these rules has been introduced to all countries. First STCW 78 convention until today, has been updated with the STCW 95, STCW-F , STCW 2010 changes. Technical drawing must necessarily take place in the educational curriculum of a marine engineers to work on the merchant ship.

4. The Concept of Technical Drawing

Technical drawing; all the information needed in a certain scale production and assembly of structural elements and the rules to be drawn within the process. In other words; work to be done can be used as a communication tool and with the necessary information is called technical drawing. Technical drawing is a way of communication between people who see technical drawing education. There is a standard drawing rules contain inherent rules of the different professions. There are unique drawing rules of the different professions. For example; mechanical technical drawing, architecture technical drawing , electrical technical drawing. These drawings serve the same purpose. (Kocabıçak, 2001 : 3)

Drawing tools are required in order to draw a good drawing. Drawing tables, T rulers, squares, rulers, erasers, cleaning brushes, pencils, drawing paper are the basic requirements applicable to the classic technical drawing. Computer-aided techniques for drawing ; design computers for the needs of software, external memory can be used to transfer data to CD, DVD, equipment as well as the printer that allows the transport of electronic data, such as floppy disks, shed drawn on official paper, such as plotter tools are used.

5. Development of the Technical Drawing

Drawings throughout history, communication tool that people use to communicate respectively. BC 30000 - 10000; The first drawings is known as the paintings made between the walls of caves. The main purpose of communication between people, is located in the transfer to the person opposite. Because drawing is a universal means of communication. A wheelbarrow wheels was the one of history's oldest drawings in the year of BC 3200. to Known first measured drawings have been used for the pyramids in the year 2600 BC. Inspired by the distance from the Pharaoh's arm from the elbow to the fingertips 'Royal Cubit' has created the first standard size used in the past. In the Babylonian Empire, technical drawing has been found on the inscription carved drawings in BC 2000. The drawing didn't have the depth and size of the Greek mentality in BC 1100. They tried to develop drawing for architecture. However, this period the technical drawings were drawn limited to two dimensions.

Leonardo da Vinci (1452-1519), Battista Alberti (1404-1472) and Raphale Sanzio (1483-1520) have made significant changes in such important artists of the Renaissance. French mathematician Gaspard Monge designed to create three-dimensional images by using 'Orthographic projection' technique in 18th century. Technical drawing increased the impact with the industrial revolution. Drawings should be understood by everyone. It is understood that should be standardized to allow for mass production manufacturing Marcel Duchamp (1887-1968), Fernand Léger (1881-1955) and Joan Miró (1893-1983) were used technical drawings to illustrate their concepts. First sectional view drawing; Russell Porter used the method of three-dimensional sectional view in the 1930s. This technique was used to create drawings in World War II. In 1950, the Japanese artist Yoshihiro Inomoto technical sections in the automotive industry with special ink pens image has widely used. Together with the development of computer technology in the 1980s began to be used in technical drawing computer programs. Drawing trial in Turkey for the first time; Mekteb-i Harbiye (Military Academy) was carried out in schools. Technical drawing has become the standard by drawing standardization prepared by the Turkish Standards Institute. In this period drawing course at the engineering school was launched. Technical drawing has been used effectively in design-manufacturing departments of the shipyards and in maritime education.

6. Implementation of Technical Drawing in Shipping

Used in the production of ships with the standard drawing technical drawing has been an integral part of the training. The scale of ship design drawings became widespread in the 1970s. Shipbuilding has provided great convenience in engineering and manufacturing to create the form of the ship.

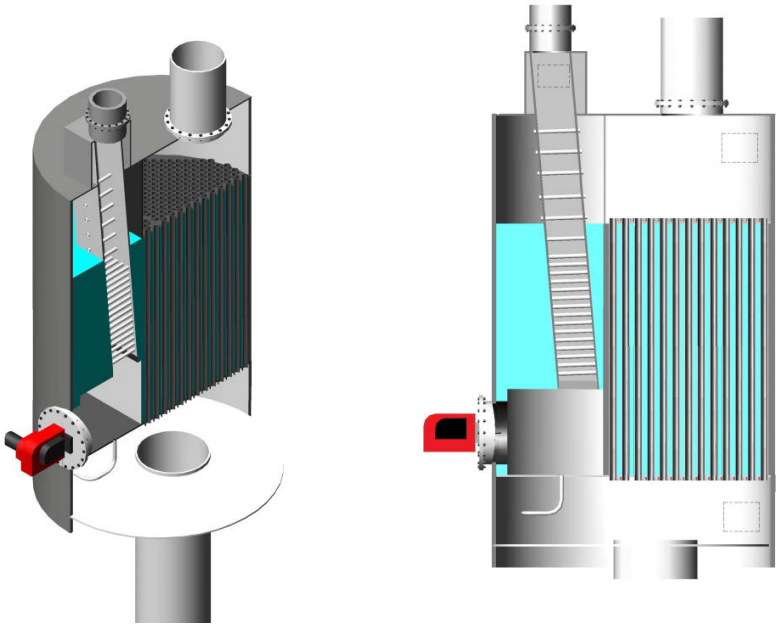

Figure 1. (a) Perspective of Ship Boiler Section; (b) Cross-section of Ship boiler

Today, ships are created in a virtual area with five of six engineer. Depending on the host computer studies are performed simultaneously. Fully three-dimensional vessel can be created in two months. Supply of defective parts in a sailing ship is difficult. However, supply of new spare part are increased by emerging technologies using computer-aided design software.

Figure 1 shows a ship boiler. A possible boiler fault conditions can be reported using the aid of computer-aided drawing software. A part in the boiler failure is possible to measured drawing. In this way, the technical drawing of the main tasks is provided with a communication. Drawing classes in schools providing education ship architecture and marine engineering. They are given in vocational school and bachelor of engineering programs.

7. Technical Drawing in Marine Education

Technical drawing courses are given in naval architecture and marine engineering vocational school (for technician) and bachelor of engineering programs. Between the years 2014-2015 Table 1-2; naval architecture vocational school (for technician) program student quantities are seen.

Table 1. Naval Architecture Vocational Schools in Turkey. (2014-2015).

School Name	Accepted Student per year
Balıkesir University	80
Bartın University	50
Çanakkele 18 Mart University	30
Piri Reis University	60
Kocaeli University	120
Ordu University	50
Karadeniz Teknik Universty	40
Bülent Ecevit University	100
TOTAL	530

Table 2. Naval Architecture Engineering Schools in Turkey. (2014-2015).

School Name	Accepted Student per year
İstanbul Technical University	36
İstanbul Technical University (Famagusta Campus)	30
Karadeniz Technical University	52
Piri Reis University	60
Yıldız Technical University	82
TOTAL	260

STCW Convention parties must implement the rules of the directory that contains the standards of each country. The regulations of this contract seamen and seamen entered into domestic law.

Table 3. Training and Examination Guidelines Appendix 9 ;
Minimum Operating Level Education Requirements for Marine Engineering in Turkey.

Technical Drawing Syllabus
a) Drawing types
b) Line
c) Perspective Projection
d) Broaches
e) Screw threads and connectors
f) Locking and retaining devices
g) Riveted type binding
h) Welded links
i) Scaling
j) Limitations
k) Geometric tolerance
l) Cams
m) Beds
n) Felt
o) The lubrication of ball and roller bearings
p) Drawing applications
q) Surface roughness
r) Sectioning
s) Intermediate sections, expansions and the presence of true greatness
t) Gear profiles and design drawings
u) Installation drawing

Table 4. Training and Examination Guidelines Appendix 9 ;
Minimum Requirements Equipments for Marine Engineering in Turkey. (2014-2015).

Minimum Requirements Equipments
Education Equipment and Publication
• 45^0 90^0 miter
• 30^0 60^0 miter
• 360^0 protractor
• 300 mm ruler
• T- ruler
Hardware and Physical environment
• Technical drawing table and CAD & CAM Software

Promotion of seafarers working on board seamen in regulation, examination requirements, while the education, training and exam guidelines on the mandatory essential tools for syllabus and course - standard materials are described. Table 3 gives the board the school undergraduate and graduate education for working technical drawings are curriculum.

Table 5. Marine Machinery Vocational Schools in Turkey. (2014-2015).

School Name	Accepted Student per year
Galatasaray University	25
Piri Reis University	60
Kocaeli University	120
Mersin University	20
Ordu University	120
Girne University	40
TOTAL	385

Necessary equipment are determined during training in Table 4. STCW Convention has established two syllabus. The first models of these training courses 7.04 (A-III / 1 curriculum) is education , as well as basic engineering courses in training for work on a ship. The second model of coursework is 7.02 (A-III / 2 curriculum) . This syllabus includes courses that are required in transition, especially in the second engineering and chief engineer. Summaries are certainly lessons to be drawing to students in undergraduate and graduate education.

Table 6. Marine Engineering Schools in Turkey (2014-2015).

School Name	Accepted Student per year
Dokuz Eylül University	46
İstanbul Technical University	102
İstanbul Technical University(Famagusta Campus)	30
Piri Reis University	80
Yıldız Technical University	62
Zirve University	40
Girne University	55
TOTAL	454

Table 7. Total accepted students per year for marine education in Turkey (2014-2015).

School Name	Accepted Student per year
Naval Architecture (Vocational School)	530
Marine Machinery (Vocational School)	385
Naval Architecture and Marine Engineering	260
Marine Engineering	454
TOTAL	1629

When examining maritime school syllabus including the technical drawing is filled to 80% of the total annual quota in 1629. These figures show that averages 1,300 students each year in technical drawing lessons.

8. Drawing and Innovative Practices in Merchant Ships

Technical drawing gives size and the assembly information to reader. Therefore, drawings on merchant ships are used for this purpose.Visual drawing quickly to supply a part that fails, production and measurement information is required picture. Installation information is needed to drawings showing the layout of the parts for. For this reason, the company or the manufacturer must provide the correct information. In order to provide accurate information it is essential to get a good technical drawing education.

Figure 2. A drawn pump shaft mechanical seal by Computer Aided Design software (CAD)

Figure 2 shows the board failed drawn with computer-aided design software is a drawn of a pump shaft assembly. No reader of the part gives information about the operation. In Figure 3 parts of the mechanical seal, it is observed the combination of assembly and perspective drawing.

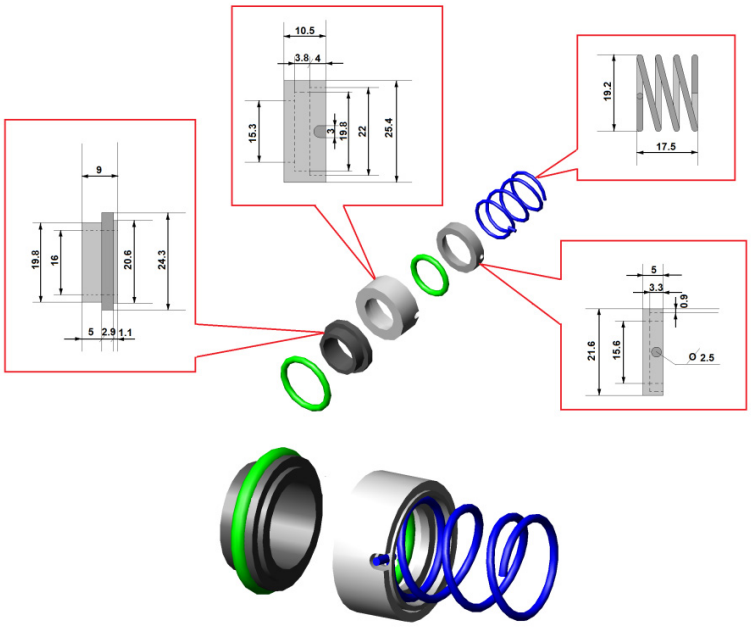

Figure 3. A drawn mechanical seal by Computer Aided Design sofware (CAD)

Figure 3 will provide a three-dimensional detection of each piece as shown, depth and shadow drawing, and also can provide each piece may also be given dimensions. Items give the basic rules of technical drawing knowledge. It has evolved with today's innovative program using the traditional paper form.

9. Classic Technical Drawing and Computer Aided Design (CAD) Comparison

When studied classical technical drawing and computerized technical drawing for maritime applications are emerging in the following strengths and weaknesses.

9.1.Classic Technical Drawing Strengths

• Hand-drawing is performed is permanent.
• Suitable for simple drawings.
• Cost is low.
• There is effective communication within the ship.

9.2.Classic Technical Drawing Weaknesses

• The power storage of large-scale drawing is drawn on paper, you need a separate partition for storage.
• There is a risk of harm to the paper when it is deleted in case of wrong done.
• Training is challenging.
• Complex drawings are drawn by taking more time, circles, arcs, tangent drawn as difficult drawings.
• Merge elements of the mounting bolts drawings, pins, bolts, welded joints are drawn difficulties.
• It is difficult to sending drawings to the ship's company or the manufacturer.
• Drawing and writing on the measurement is difficult.

9.3. Computer Aided Design Strengths

• Ensure that the paper drawn in a virtual environment is easy storage of large-scale drawing, there is no need for a separate partition for storage.
• There is a case when there is a risk of damage deleted the wrong done to the paper.
• Training is easy after the basic technical drawing knowledge.
• Complex drawings are drawn without much time spent, circles, arcs, tangent drawn as easily drawings.
• Merge elements of the mounting bolts pictures, pins, bolts, welded joints are easily scratched.
• Easy to sending drawing to the ship's company or the manufacturer.
• Parts can be created if the situation works in animation.
• The printer can print on paper with the help of the desired size.
• Compatible with other computer programs.
• It can be a return to the past and undo the wrong process when drawing.
• On the drawing and dimensioning text it is easy.

9.4. Computer Aided Design Weaknesses

• Drawings should be backed up in a virtual environment is prepared otherwise be cleared in time.
• It is difficult to use without knowing the basic rules of technical drawing.
• The program is difficult to adapt to the current version of the software developed by the company.
• there may be discrepancies between systems with older versions of computer equipment.
• Programs are needed for high specification computers to use in an efficient manner.
• The high cost of licensed software is used.
• Older version drawing files may not be opened in new version.

10. Innovations in production & Findings

Today, understanding the technical picture continues. Computer-aided design programs every day continues to bring great convenience in production with new features. Also drawing the help of computer technology training simulators will be used to help to make parts in a virtual environment. The movement of the pieces with the help of

technical drawing programs, forces suffered during the movement of materials, types of material and help to all kinds of engineering calculations. Based on actual body measurements with a laser technology it has become well done modeling. Despite the rapid development of the maritime industry this use is heavy compared to other sectors. The main reasons are economic reasons. Market driven product life cycle when new programs are getting longer and more frequent use will be widespread in the marine market. Technical drawing software in innovation thanks to the drawn parts of the simulation performed, together dimensional compliance of the parts can be controlled.

In this way; the error in the drawing risk close to zero. Instead of drawing can be sent instantly realized the world's crossed another and creating pieces appeared in the actual size researched alternative solutions all kinds of problems on this model.

In response to this rapid development of technology in the world, training arguments does not change at the same rate. Drawing training in the maritime education in Turkey is based on the classic drawing. Some computer programming courses is also the easier, as shown in Table 3 courses are supported by computer-aided design program. Promotion of computer-aided design training programs, training of trainers course that the technical picture, it is important to ensure updating of software in software companies of educational institutions.

11.Conclusion

Drawing on the maritime education has an important place. Ship owners terms of trade are expected to ship propellers turning continually. During the course of the ship by ship's failure to address a fault that can occur toward defining the company or the manufacturer must provide the correct information. This is due to the combination of the technical picture with the easiest way to modern technology. In addition to compulsory education in marine engineering institutions, a possible fault conditions on the ship with the help of computer-aided programs to better reporting or a piece detailing the failure to be able to scale more details:

Dissemination of technical drawings in all maritime education science course,
Supported by computer-aided design of technical drawing course,
Computer-aided design training institutions free of license issuance,
Ensuring the training of trainers course that the technical drawing,
Computerized techniques necessary to make the drawing,

In this regard, it developed new software is appropriate for ensuring the compatibility of the software in both educator and educational institutions.

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